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ABSTRACT

The Hong Kong Polytechnic University's strategic plan for 2001 stipulated that a credit-based system should be adopted for all of its programs. The Department of Computing provides service teaching in computing to all departments at Hong Kong Polytechnic University, necessitating the standardization of computing instruction. One of the issues that needs to be addressed in the conversion of existing programs to a credit-based system is the maximum use of common subjects. This paper reports on a systemic approach in the design of common service modules in the subject of computing. It presents the findings of current teaching of the subject of computing, presents the views of course leaders and local managers on their requirements on the subject, and proposes viable common service modules in information technology/information systems (IT/IS) to cater to the needs of many students who are non-computing majors. It was found that the course leaders of this institution and managers of some local organizations have similar requirements for the education and training given to students. (AEF)

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A SYSTEMIC APPROACH IN DESIGNING COMMON SERVICE MODULES IN THE SUBJECT COMPUTING (IT/IS)

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The Hong Kong Polytechnic University's strategic plan for 2001 stipulated that a credit-based system should be adopted for all of its programs. One of the issues that needs to be addressed in the conversion of existing programs to a credit-based system is the maximum use of common subjects. The author undertook a funded project in 1996 which was to investigate the viability of having common service modules in Computing (IT/IS). This paper reports on a systemic approach in the design of common service modules in the subject Computing. The Department of Computing provides service teaching in Computing to all departments in this university and it is necessary to standardize the teaching of Computing. The current service teaching of IT/IS has been reviewed. The subject requirements of both the Course Leaders in this institution and the managers of local companies have been gathered through a questionnaire. It has been found that the Course Leaders in this institution and the managers of some local organizations have quite similar requirements of education and training but there are some differences. These findings are presented. Overall, the findings provide some valuable inputs for the design of 4 common service modules for the year-1 and/or year-2 sub-degree and degree students in this institution.

INTRODUCTION

This paper reports on a systemic approach in the design of common service modules in Computing (IT/IS). It is to address one of the issues that the conversion of existing programs to a credit-based system is the maximum use of common subjects.

The Hong Kong Polytechnic University's Strategic Plan for 2001 stipulated that a credit-based system should be adopted for all its academic programs. There is a need to investigate the viability of having some common service teaching modules for the subject Computing(IT/IS). Thus the university can increase the access to its academic programs, permitting a large number of students, not just those who can study full-time, but including those who will take specific subjects as part of continuing professional education.

Common service modules in (IT/IS) should be designed to cater to the needs of all students in this university. In the existing servicing subject modules in (IT/IS), it is common to find that students are taught software packages and programming languages in different subjects which have quite similar contents. Knowing their needs and establishing common modules in these areas may alleviate the problem of having different software. Much efforts can be saved in subject materials development. Also, the software packages and programming languages can be better managed and controlled.

SPECIFIC OBJECTIVES

This paper aims to :

a) Present the findings of current service teaching of the subject Computing (IT/IS).

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b) Present the views of Course Leaders and local managers on their requirements in the subject Computing (IT/IS).

c) Propose viable common service modules in IT/IS to cater to the needs of many students who are non-computing majors.

METHODOLOGY

Review Current Teaching of (IT/IS)

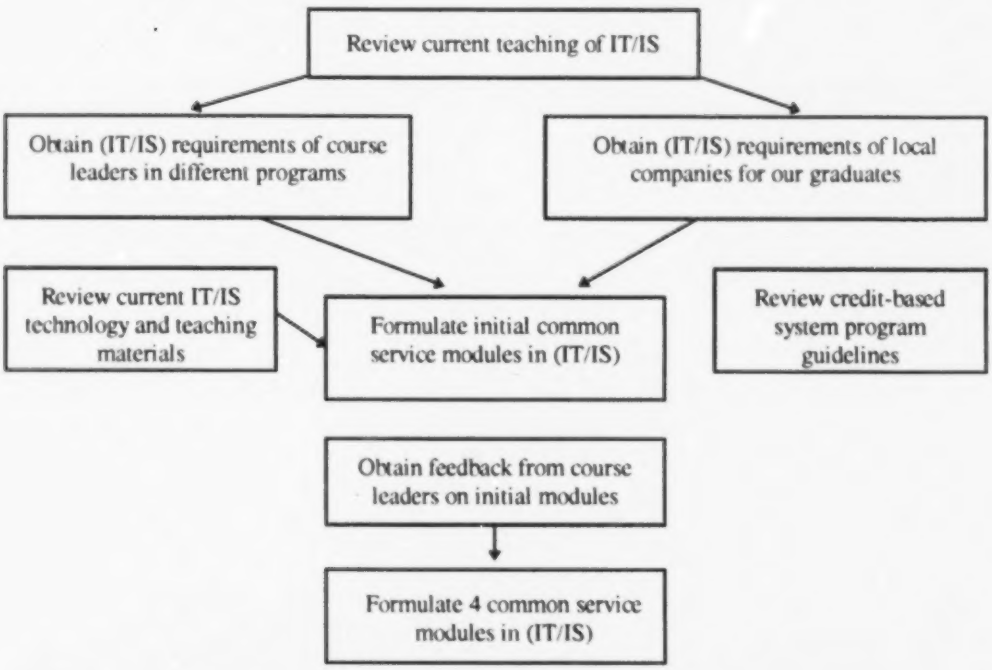
The teaching plans of all of the (48) servicing subjects ranging from High Diploma to Post-graduate levels have been reviewed and they have been decomposed into topics areas. This will provide a good understanding of how the subject of Computing (IT/IS) is currently taught in different programs. Information can be obtained on the popularity of common topics, the allocation of hours(lecture, tutorial, laboratory etc.) in various topics and also the methods by which the students are to be assessed. Furthermore, this will also give information on the average hours spent on each topic area which provides a guideline for subsequent module design.

Obtain (IT/IS) Requirements of Course Leaders in Different Programs

A questionnaire was created after the current teaching pattern had been reviewed. The questionnaire was sent to all Course Leaders in the servicing departments to determine requirements for IT/IS knowledge that their students should acquire. It was expected that many different programs may have new requirements to meet the changing needs in the professions. The requirements of (IT/IS) in different programs were reviewed for commonalties.

Obtain (IT/IS) Requirements of Local Companies for Our Graduates

This step is considered to be important as our education and training for students should meet the requirements of the local industry. The questionnaire which was sent to Course Leaders, was modified slightly and sent to managers of the local companies who had given recruitment talks to students from different disciplines. This method of information collection is to ensure that the (IT/IS) knowledge given to students will be


Review current teaching of IT/IS
Obtain (IT/IS) requirements of course leaders in different programs
Obtain (IT/IS) requirements of local companies for our graduates
Review current IT/IS technology and teaching materials
Formulate initial common service modules in (IT/IS)
Review credit-based system program guidelines
Obtain feedback from course leaders on initial modules
Formulate 4 common service modules in (IT/IS)

relevant to the local industry. It is to the benefit of our students that they will be able to make immediate contributions without much retraining.

The methodology used in designing the common service modules is as below:

Review Current (IT/IS) Materials

Having obtained some ideas on the possible topic areas for adoption, 6 publishers have been consulted on the availability of textbooks in (IT/IS). The trend in (IT/IS) is to be identified through publications in journals, magazines, articles in newspapers, seminars, video CD-ROM and video tutorials. This is to determine if up-to-date teaching materials are available to support teaching.

Review Credit-Based System Program Guidelines

In adopting the credit-based system, a common framework for academic program design should be used. There are some general guidelines established by this university for a Credit-based system. Subject module design will adhere to the standard guidelines.

Formulate Initial Common Service Modules in (IT/IS)

Initial common modules in IT/IS were established taking the following into consideration:

a. The current teaching pattern.
b. The requirements of Course Leaders in different programs.
c. The requirements of local companies.
d. The current trend in IT/IS.
e. The availability of teaching materials.
f. The credit-based system academic program design policy.

Obtain Feedback from Course Leaders on Proposed Modules

The proposed modules have been sent to Course Leaders for their comments and further suggestions. Their feedback would be used for subsequent module formulation.

Formulation of Common Service Modules in (IT/IS)

The input from Course Leaders provide valuable information for the revision of the proposed modules and creation of additional modules. The final version of the modules were produced with careful consideration of the suggestions and comments given.

FINDINGS

Current Teaching Pattern

The current teaching patterns could be obtained by decomposing the teaching plans into topics. As some of the teaching plans are not in standard format, it is required that experience and judgment be used in determining how the topics are grouped.

Among the computing subjects in different programs, it has been found that some topics are popular and they are :

- Hardware
- Software
- Database system
- Data Communication and Networking
- Information systems theory and management
- Programming concepts and algorithm design
- Software packages such as wording processing, spreadsheet and database
- Pascal programming

Each academic year has 2 semesters each of which lasts for 14 weeks. About 50% of the servicing subjects follow a two semester sequence. 53% of the subjects include a test as part of the subject assessment. 76% of them have assignments for students. On average, the proportion of lecture, tutorial and laboratory hours are in the ratio of 43:23:34. Also, the average weighting of coursework and final examination is 43% and 57% respectively.

There are also other pieces of useful information which can serve as guidelines for subsequent module design and they are as follows:

a. 11 Subjects are introduced in semester 1 and 10 subjects are introduced in semester 2. Twenty eight subjects require 1 academic year.

b. The proportion of hours given to lecture, tutorial for a subject without laboratory is in the ratio of 64 : 36.

Requirements of Course Leaders

Course Leaders and managers of local companies have been sent a questionnaire. It has two parts: General subject module information and subject module content (Lecture, Software packages, Programming). The 2-page questionnaire was so designed that it is easy to complete. This design will also ensure good responses. The questionnaires were sent out via the internal mail system and many of the Course Leaders have been very cooperative in completing and returning them. Some have given additional suggestions for my consideration.

The response rate was 85% and this represented a majority of the views on the requirement of (IT/IS) on the Common modules. A spreadsheet was created with all of the requirements for Course Leaders. This can facilitate 'What if' analysis in the module design. For example, What will be the largest number of students if the subject module is of 1,2 or 3 semesters duration and/or has 2 lecture hours per week. Information of this kind will be useful in designing the subject modules which will suit a majority of students. A summary requirement of the Course Leaders on general subject module information are as follows:

a. Duration for the common module

Duration for the module	1 Semester	2 Semesters	3 Semesters
No. of Courses	9	21	5

Most Course Leaders prefer the subject module to be 2 semesters.

b. Number of courses indicating the required number of Lecture, Tutorial and Laboratory hours per week

No. of Hours per week	0	1	2	3	4	>4
Lecture	1	15	15	1	0	3
Tutorial	16	13	3	1	0	2
Laboratory	4	12	14	1	2	2

This indicates that for most courses, the preference is to have 1 to 2 hours of lectures, 0 to 1 hours of tutorial and 1 to 2 hours laboratory per week.

c. Nature of the subject module(Core/ Elective)

Nature of the subject module	Core	Elective
No. of courses	35	0

The (IT/IS) module(s) are considered to be core required subject.

d. Level of study(sub-degree/Degree/Post-graduate)

Level of Study	Sub-degree	Degree	Postgraduate
No. of courses	11	24	0

The (IT/IS) module(s) are for sub-degree and degree courses.

e. Year of study

Year of study	Year-1	Year-2	Year-3
No. of courses	18	15	2
No. of students	405	1655	200

The subject module(s) can be introduced in year-1 or year-2.

f. Mode of study(full/others)

Mode of study	Full-time	Others
No. of courses	34	1

On the contents of the subject module, each Course Leader is requested to give an assessment on the importance of each topic on a scale of 1 to 5 (1 is the least important and 5 is extremely

important). The average score of each topic was then computed and represents the overall view of the importance of each topic. The average scores were then ranked in descending order of significance and this shows the relative importance of each topic. The popularity of the topics have been found to be as follows:

Lecture Contents	Average score
Computer Applications	3.92
Computer Software	3.79
Database Systems	3.33
Management Information Systems	3.21
End User Computing & IT Management	3.17
Software packages	**Average score**
DOS / Windows	4.17
Word Processing	4.00
Integrated Software Packages	3.92
Spreadsheet	3.67
Database	3.38
Programming Languages	**Average score**
C++	2.08
Pascal	2.08
FORTRAN	1.96
C	1.88
QBasic	1.75

The above findings represent the responses of the Course Leaders. Some Course Leaders expressed many different requirements. e.g. Macintosh operating system as well as Windows, Business simulation, Statistical package, Software packages (wording processing, database), Chinese Computing, Object Oriented concept, Artificial intelligent, Expert systems, Photo Image Manipulation etc. Some of their requirements may not be easily incorporated in the common modules.

Requirements of Local Companies

The same questionnaire was also sent to managers of the Hong Kong companies who gave recruitment talks to our students. The requirements of the managers were sought as our curriculum should be appropriate to the needs of the local companies. A spreadsheet was created with all of the requirements gathered. A total of 12 responses have been received. A few managers have been interviewed and also the Hong Kong Institute of Engineers, a professional body has also been interviewed. Some of the managers expressed the need for the followings :

- SQL
- Software Development process
- Quality business impact with IT/IS
- Accounting related software
- Assignment that requires team formation for practice
- Computer applications
- Project Management
- More concentration on MIS

Since the requirements of the Course Leaders and that of the local industry have been gathered, it would be useful to investigate if there is any similarity or difference in requirements between these two parties. The result of the analysis can strongly support the design of the subject modules. It has been found that the similarity of requirements of important topics are as follows :

Popular topics perceived tobe important by Course Leaders and Managers	Average score of Course Leaders	Average score of Managers	Mann-Whitney Test Z value, (Asymp.Sig.)
Lecture Contents			
Computer Applications	3.92	4.08	-0.767 (0.443)
Computer Software	3.79	4.08	-1.298 (0.194)
Database Systems	3.33	3.83	-1.661 (0.097)
Mgmt. Information Systems	3.21	3.83	-2.411 (0.016) *
End User Computing & IT Management	3.17	3.58	-1.663 (0.096)
Data Communication & Networking	3.04	3.92	-2.700 (0.007) *
Privacy, Security & Ethics	2.88	3.58	-2.296 (0.022) *
Systems Analysis and Design	1.92	3.50	-3.581 (0.000) *
Software Packages			
DOS / Windows	4.17	3.83	-0.269 (0.788)
Word Processing	4.00	3.92	-0.205 (0.838)
Integrated Software Packages	3.92	4.25	-1.570 (0.116)
Spreadsheet	3.67	4.00	-1.285 (0.199)
Database	3.38	4.00	-2.112 (0.035)
Internet	3.38	3.33	-0.756 (0.450)
Project Management	2.42	4.08	-4.329 (0.000) *
Programming & Languages			
C++	2.08	3.58	-2.989 (0.003) *
Visual Basic	1.75	3.50	-3.909 (0.000) *
Fourth Generation Languages	1.81	3.25	-3.230 (0.001) *
C	2.00	2.92	-2.346 (0.019) *

Average score of Course Leaders and Managers are provided for each of the lecture topics. Mann-Whitney Test was used to test the mean differences of statistical significance at 0.05 level. Those marked with an "*" indicate that the mean differences are significant. The analysis of findings provide some interesting results. Management information systems, Data communication & networking, Privacy, Security & Ethics, Systems analysis & Design and Project Management have been conceived to be important in the local industry but they are not considered to be that important in the PolyU environment. C++, Visual Basic, 4th Generation Languages and C are considered to be the most popular programming languages in the local companies. In general, Programming Languages are considered to be less important compared with theoretical lecture content and software application packages.

Availability of Current (IT/IS) Text Books

It has been found that a large volume of textbooks published in recent years are available to support teaching. There are also plenty of materials available in other sources such as video CD-ROM, journals etc.

Policy on the Design of Credit-Based System

The policy on the design of a credit-based system needs to be followed and to impose a design constraint. Each academic year has 2 semesters each of which has 14 weeks. Academic programs should be so designed that they are built-up of subjects of standard sizes and consist of subjects which have values expressed in terms of credits. In terms of student effort, a student is expected to do 35 to 45 hours of study (inclusive of contact hours, private study etc.) to earn a credit. However a credit is to be translated into contact hours. Hours of supervised work and private study will depend on the teaching/learning activities and the nature of the subject matter.

The standard credit value of a subject is 3. It is suggested that a student will normally take 18 credits (for undergraduate courses) which are equivalent to 6 subjects of 24 credits in a semester.

Formulate Initial Common Service Modules

Two common service modules each of which offers 3 credits, have been formulated. One module is purely theoretical and the other is for hands-on application skills. The topics to be included in the modules are those which have been perceived to be important by Course leaders and managers. The 2 modules did not have programming component as programming languages were not considered highly by either Course Leaders or managers in Hong Kong. Also, the inclusion of programming languages may not give these modules cohesion.

Feedback from Course Leaders

The 2 formulated modules were sent to Course Leaders for review and comments. About 50 % supported them and the general comments were as follows : a). Programming should be taught. b) The students can take only 1 subject module and the module should have both theoretical and practical components. c). The modules should be 2 credits instead of 3.

FORMULATION OF COMMON MODULES

Having reviewed the suggestions and comments of the Course Leaders, 4 common service modules have been formulated. A brief summary of them are :

Introduction to Information Technology

This module is a purely theoretical subject in IT/IS. Topics include computers, Data communication & Networking, Database systems, Management Information systems and End-user Computing.

Applied Information Technology

This module is a practical one in the use of information technology applications. Students will work with some popular packages. They will be given an opportunity to study and communicate through the use of IT. In addition, students can choose an application package to suit their own needs.

Computer Programming

This module is designed to introduce students to the concepts of structured programming in a popular third-generation language e.g. C.

Fundamentals of Computing

This module has both theoretical and practical components. Students are provided with the fundamental knowledge of computing and have the opportunity to develop the necessary practical application skills.

CONCLUSION

This paper has described a systemic approach to designing common service modules in IT/IS. The current service teaching of IT/IS have been reviewed. The requirements of both the Course Leaders in this institution and the managers of the local companies have been solicited. Initial modules had been formulated for review and comments by Course Leaders and their comments have been taken into consideration for further enhancement of subject module design.

It has been found that the Course Leaders of this institution and managers of some local organizations have quite similar requirements for the education and training given to our students. Common service modules can be designed tailored to requirements for the year-1 or year-2 sub-degree and degree students in many different programs. It is hoped that they will be adopted for the future credit-based system in this institution.

Finally, It is also hoped that my experience in designing common subject modules can be shared among academics in Computing.

ACKNOWLEDGMENTS

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